Appendix S3: Results of literature review

Appendix for the paper "The per-patient costs of HIV services in South Africa: Systematic review and application in the South African HIV Investment Case" by Gesine Meyer-Rath, Craig van Rensburg, Calvin Chiu, Rahma Leuner and Steve Cohen

No.	Author, year 1. Cotrimox	Objective	Target population, setting, level of care	Cost perspective	Costing method	Costing period	Mean cost (2016 USD)	Range (2016 USD)	ARVs	Other drugs	Labs	Radiology	Staff/Consultation	Consumables	Overhead ¹	Equipment	Iransport Inpatient	Other
1	Hausler (2006)	Cost and effectiveness of a package of TB and HIV interventions	General population in Cape Town; CHC, PHC and STI clinic	Provider	Full economic cost, ingredients approach	2001 - 2002	Screening for cotrimoxazole preventative therapy \$3.13 in community health centre \$1.57 primary health clinic Cost of screening per person started on cotrimoxale preventative therapy \$7.84 in community health centres \$2.97 in primary health clinic Cost of 6 months of cotrimoxazole preventative therapy \$12.54 community health centre \$9.40 primary health clinic	N/S		x			x	x	x	x		

¹ includes other capital costs in some instances

3	Chimbindi (2015)	Cost associated with accessing public sector care over different stages of illness (TB, pre-ART, ART)	General population in rural KwaZulu- Natal, PHC	Patient	Economic and financial costs, bottom up approach	2009-2010	Financial costs per month \$18.61 pre-ART \$17.84 on ART Monetized time costs \$6.45 pre-ART \$9.49 on ART	All SD \$14.61-22.56 \$15.37-20.38 \$5.07-7.84 \$4.11-14.88		x		x			x	Opportunity costs
6	(2012)	Explore barriers to access of ART at different treatment sites	Adult population (>18) in rural and urban treatment sites	Patient	Full financial costs, bottom up	N/S	Expenditure past month \$6.43- to reach ART facility (rural) \$18.34- all healthcare (rural) \$1.41- reach ART facility (Urban) \$5.77- all healthcare (Urban)	N/S		x					х	Patient health expenses
7	Cobb (2013)	Cost of applying WHO guidelines for the nutritional management of HIV-infected children		Provider	Incremental financial costs, ingredients	2010	\$56.25 /child nutrition, 26 weeks, requiring NCP-B only \$178.33 / child nutrition, 26 weeks requiring NCP-C and NCP-B \$923.63 average cost of supplying ART	N/S	x							Nutritional supplement
9	Deghaye (2006)	Provide comprehensi ve costing of HAART to health care workers in different hospitals	Health Care Workers	Provider	Full Economic and incremental financial costs, bottom up	2004	Total financial cost per year \$1379.18 urban \$896.74 peri-urban Total economic cost per year \$1399.80 urban \$1066.89 peri-urban	N/S	х	x	x	х	х	x		

11	Harling (2007a)	Cost of a dedicated ART clinic over pre-ART and 2 years of ART	General population	Provider	Full financial costs, top down	March 2004- Feb 2006	Cost per patient month \$40.81 in 2004/05 \$36.94 in 2005/06 Cost per visit \$55.49 in 2004/05 \$42.16 in 2005/06	N/S	х	x				х	х	х	
16	Leisegang (2009)	Describe the direct costs and establish cost drivers over time in HIV managed care programme	19+ yrs old, ART naïve	Provider	Incremental financial costs, ingredients using AfA data base	N/S	Monthly cost \$96.96 before ART \$484.79 peri-ART \$193.92 on ART	N/S	x	x							
18	Long (2010)	Estimate the costs and outcomes of second line ART	Adult patients on second line treatment	Provider	Full financial costs, bottom up	N/S	Cost 12 months after initiating \$1045.39 all outcomes \$1278.26 care and responding \$1122.01 t in care and not responding \$482.88 no longer in care	N/S	х	x	X		х	х	х		
19	Martinson (2009)	Estimate the cost of initiating and maintaining patients on ART	Adults	Provider	Full financial costs, bottom up	Octobe r 2004- March 2005	Monthly costs \$96.48 overall per patient \$61.77 per patient not on ART \$117. per patient on ART \$105.24 for month prior to ART \$206.25 month of ART initiation \$127.69 after ART initiation		х	x	x	х	x			x	
21	Meyer-Rath (2013)	Annalise ART cost	Children (initiated ART, 13 yrs old)	Provider	Full financial costs, bottom up	2005- 2009	Per 24 month outcome \$723.63 all in care \$652.11 all in sample \$304.88 not in care \$758.45 in care not responding \$707.63 in care responding		х	х	х	х	х	х	х		

22	Moshabela (2012)	Investigate factors associated with patterns of plural healthcare utilization	Adults	Patient	Incremental financial costs, bottom up	April 2008- March 2009	Report expenditure 4 weeks prior to ART visit \$5.65 private chemist \$8.47 self-care \$17.88 doctor \$6.59 primary health clinic	\$2.82-12.23 \$2.82-23.52 17.88-28.23 0.94-2.82 IQR		x		x					
25	Rosen (2007)	Estimate the costs patient occur in obtaining ART	Adults	Patient	Full financial and economic costs, bottom up	July 2005- June 2006	Total cost per visiit \$15.83 urban hospital \$10.20 informal settlement clinic \$18.88 rural clinic \$14.62 all					х				х	Opportunity cost
26	Rosen (2008)	Estimate outpatient cost per patient in care and responding to treatment	General population	Provider	Full financial costs, bottom up	N/S	Annual cost per patient initiated: \$747.59 referral hospital \$886.04 private GP \$921.64 HIV clinic \$1113.48 NGO clinic \$917.68 all sites Cost to produce patient in care and responding: \$115.46 referral hospital \$1703.84 private GP \$1463.54 HIV clinic \$1465.52 NGO clinic \$1422.01 all sites	N/A	х	x	х	х	X	X	x		
27	Tagar (2014)	Describe facility-level cost of ART in a random sample of facilities	General population	Provider	Full financial costs, top down	2011	Average cost of treatment per year \$521.46 weighted mean \$597.71 simple mean Average 1st line cost \$160 cost for adults		х	x	х	x	х	x	X		Nutritional

28	Vella	Identify	General	Provider	Full financial	April	6 month cycle cost:	6 month	Х	х	х	х	х	Х	х	х		
	(2011)	which	population		costs, bottom	2005-		cycle (95%)										
	,	delivery			up	March	\$471.58 Part time MD part time nurse,	\$447.96-										
		profiles of			'	2006	<200 new patients per MD per yr	495.21										
		ART sites					\$484.38 Part time MD part time nurse,											
		influenced					>= 200 new patients per MD per yr	\$476.51-										
		retention and					\$509.98 full time MD + full time nurse,	492.26										
		at what cost					<200 new patients per MD per yr											
		patients were					\$531.64 full time MD + full time nurse,	\$502.10-										
		retained					>= 200 new patients per MD per yr	517.86										
							Incremental cost per patient on	\$506.04-										
							treatment after 10 years:	557.24										
							\$8864.60 Part time MD part time nurse,											
							<200 new patients per MD per yr											
							\$12081.02 full time MD + full time nurse,	ICERs (95%)										
							<200 new patients per MD per yr											
								\$8,369-9,367										
								\$10,430.97-										
								13,709										
29	Wouters	Investigate	General	Patient	Full financial	2004-		SD									х	
	(2010)	characteristic	population		costs, bottom	2006	\$1.22 mean transport cost	\$0-2.31										
		s of patients			up													
		enrolled in																
		public sector																
		ART																
		programme																
		in Free State																
		nd outpatient co		1	T	1 .		Γ				1				,		
5	Cleary	Cost and cost		Provider	Full economic	N/S	Cost per clinic visit		Х	х	х	Х	Х	Х	Х	Х		х
	(2006)	effectiveness	population in		cost,		\$22.11 ART											
		of HIV	Khayelitsha,		ingredients		\$21.64 no-ART											
		services, cost	Cape Town,		and step													
		per LY and	HIV clinic for		down		Incremental cost effectiveness	40044 10-										
		QALY gained	ART, tertiary		approach		\$1,187.25 per LY gained	\$984-1,187										
			and				¢1 220 C2 707 OALV	per LY gained										
			secondary facility for TB				\$1,329.62 per QALY	\$1,102-1,330 per QALY										
			Tacility for TB					per QALT										

12	Harling (2007b)	Analyse ART costs over 3 treatment periods	General population	Provider	Full financial costs, top down	March 2004- Feb 2006	Pre ART costs \$409.19 intention to treat \$380.45 on program Treatment costs per patient year 1 \$2,533.71 intention to treat \$2045.73 on program Treatment costs per patient year 2 \$1,389.83 intention to treat \$1.392.74 on program	N/S	x	x	x			x	x	x	х
15	Kevany (2009)	Determine the costs of inpatient and outpatient at a dedicated ARV referral unit	Older than 13 yrs	Provider	Incremental economic costs, bottom up	Apr & May 2005	Outpatient costs \$194.87 cost per patient \$148.47 cost per visit Inpatient costs \$148 cost per inpatient \$488.49 cost per day	N/S	x	x	х	x	x				x
20	Meyer-Rath (2012)	Compare resource use and cost between 2 settings	General population, CD4 < 200	Provider	Full financial costs, bottom up	April 2006- Dec 2008	Inpatient costs per year \$304.99 urban \$366.34 semi-urban Outpatient costs per year \$606.48 urban \$610.86 semi-urban Total costs per year \$911.47 urban \$977.20 semi-urban	95% CI \$127.08- 482.03 \$70.99- 662.57 \$552.14- 660.81 \$589.82- 631.01 \$701.13- 1121.80 \$680.09- 1273.42	x	x	х	x	x	х	x	x	x

23	Nachega	Determine	Adults	Provider	Incremental	N/S	Mean monthly cost	SD	х	х	Х	Х	Х		Х	
	(2010)	the effect of		(private)	financial		\$356.45 all patients	\$0-996.45								
		ART			costs, top		\$362.14 adherence 4-45%	\$214.52-								
		adherence on			down		\$402.15 adherence 40-75%	938.80								
		the direct					\$358.86 adherence 75-91%	\$400.61-								
		health care					\$302.26 adherence 92-100%	1,204.90								
		costs among						\$134.31-								
		adults					Median monthly cost	852.02								
							\$203.44 all patients	\$0- 935.90								
							\$202.47 adherence 4-45%									E C
							\$170.66 adherence 40-75%	IQR								Other
							\$208.26 adherence 75-91%	\$147.52-								
							\$215.97 adherence 92-100%	303.71								
								\$135.95-								
								323.96								
								\$102.20-								
								319.13								
								\$140.77-								
								345.17								
								\$151.37-								
						200-		327.81								+
24	Naidoo	Measure the	General	Provider	Incremental	2005-	Total median variable cost per patient	IQR	х	Х	Х	х	Х	х	×	
	(2015)	effectiveness	population		financial	2010	month									
		of initiating			costs, bottom		C100 F7 with ADT within 1 we also	602.20								
		ART at			up		\$100.57 with ART within 4 weeks	\$93.38-								
		different					\$96.96 ART after intensive phase of	142.62								
		points in TB					treatment	\$89.99-								
		treatment					\$86.59 ART after completing treatment	126.49								
								\$78.10-								
								113.76								
								113.70								\perp
	3. Inpatie	nt cost														

8	Smith de Cerif (2009)	Determine whether reasons for hospitalizatio n were different for HAART vs non-HAART	Adult population (>18), secondary hospital, Cape Town	Provider	Full financial costs, ingredients (some costs from Cleary 2006)	July 2003- March 2004	Total hospitalization cost \$1513.91 in HAART group \$1401.09 in NON-HAART group	IQR \$777.91- 2855.9 \$873.53- 2231.64	x	x	x	x	x	x	x	x	
42	Meyer-Rath (2013)	Compare hospitilisatio n rates and costs in cohort of HIV+ patients before and after ART initiation	Adult population (over 18 years)	Provider	Full financial costs, ingredients approach	2009	Cost per patient per year, pre ART \$142.21 at 100 cells/mm³ \$74.34 at 101 – 200 cells/mm³ \$56.56 at 201 – 350 cells/mm³ \$35.55 at >350 cells/mm³ Cost per patient per year, on ART \$330.49 at 100 cells/mm³ \$74.34 at 101 – 200 cells/mm³ \$56.56 at 201 – 350 cells/mm³ \$35.55 at >350 cells/mm³	95% CI \$76.76- 234.33 \$39.59- 122.82 \$56.56-83.23 \$20.20-54.14 \$120.40- 694.91 \$75.96- 327.25 \$58.18- 139.79 \$18.58-64.64									

43	Sinha	Determine	HIV+ and HIV	Provider	Full financial	2000 –	HIV+ costs, cost per ALRTI episode	95% CI	Х	Х	Х	х		Х	Х	
	(2012)	the economic	- Children (>6	and patient	costs, top	2001	\$969.61, direct paediatric ward costs,	\$4874.53-								
	,	burden of	months)		down for bed		(retrospective period)	1,064.44								
		acute lower	,		days, bottom		\$1,117.10 direct paediatric ward cost	\$892.08-								
		respiratory			up for other		(prospective period)	1342.11								
		tract			resource use		\$198.28 short stay ward costs									
		infection					(prospective period)	\$184.32-								
		(ALRTI) in					\$11.88 patient costs	193.90								
		South Africa														st
							HIV- costs, cost per ALRTI episode	\$8.78-16.76								Opportunity cost
							\$804.31, direct paediatric ward costs,									nit
							(retrospective period)									拒
							\$809.10.10 direct paediatric ward cost	\$711.75-								000
							(prospective period)	896.07								ŏ
							\$193.90 short stay ward costs									
							(prospective period)	\$646.32-								
							\$10.37 patient costs	971.88								
								\$184.32-								
								212.25								
								40 70 46 70								
48	Long (2016)	Report the	Adult (>18)	Provider	Full financial	2012-	Cost per HIV+ admission	\$8.78-16.79 N/S	Х	Х	.,	+.	x	.,	.,	
48	LOTIS (2016)	primary	Adult (>18)	Provider	costs, bottom	2012-	\$3,518 renal disease	IN/S	Х	Х	Х	×	X	Х	Х	
		reasons for			-	2013	\$2,298 drug adverse event									
		HIV-related			up		\$2,205 endocrine and metabolic disease									
		admissions at					\$2,172 HIV and related OI									
		a regional,					\$2,135 gastro-intestinal disease									
		urban					\$2,096 unknown reason for admission									
		hospital					\$1,818 hematologic disorder									
		Позрітаї					\$1.719 parasitic infection									
							\$1,714 TB and other mycobacteria									
							\$1,677 musculo-skeletal									
							\$1,250 other									
							\$1,590 all									
	4. NIMART		1	1	1	1	1	1	1		1			1	l l	

30	Barton (2013)	Estimate cost effectiveness of nurse-led ART vs doctor lead ART	population (16+)	Provider	Full financial costs, bottom up	2008-2010	Cost at 12 months post enrollment, patients CD4 <=350 and not yet on ART \$383.05 nurse lead ART \$285.70 doctor lead ART \$23,444 per death averted Costs at 12 months post enrollment, Patients on ART at enrollment 460.68 nurse lead ART 402.91 doctor lead ART 12,042 per undetectable viral load	95% CI \$17,529- 19,625	x	x	x	x	x			×	Set up costs
31	Foster (2012)	Evaluate indirectly supervised pharmacists' assistant (ISPA) and nurse based care against full time pharmacist	General population	Societal	Incremental financial and economic costs, bottom up	2009	Average annual costs: \$109.67 per patient with full time pharmacist (baseline) \$10.68 incremental cost for patient through ISPA \$27.11 incremental cost per patient through nurse Average societal cost per visit: \$14.10 with full time pharmacist (baseline) -\$2.89 incremental cost with ISPA -\$0.11 incremental cost with nurse Average cost to patient per visit \$8.54 with full time pharmacist (baseline) -\$2.21 incremental cost with ISPA -\$3.19 incremental cost with nurse Average cost to patient per visit \$5.57 with full time pharmacist (baseline) -\$0.69 incremental cost with ISPA \$3.07 incremental cost with nurse	N/S			x			x	x		Indirect patient costs

32	Long (2011)	Evaluate cost effectiveness	Stable patients on	Provider	Full financial costs, bottom	N/S	Cost per patient:	Cost per patient (SD)	х	х	х	×	х	х	х	
		of down	ART > 11		up		514.55 DR/Hospital	\$379.95-								
		referring	months					649.15								
		from doctor					463.95 Down referral									
		managed to						\$70.40-								
		nurse						557.51								
		managed ART					Cost per patient in care and responding:									
		in primary					526.01 DR/Hospital									
		health care					469.98 Down referral	Cost in care								
								(SD)								
								\$403.81-								
								648.20 \$385.67-								
								553.69								
45	Fatti	Compare	ART naïve	Provider	Incremental	Jan	Mean staff cost per visit	N/S				х				\top
	(2016)	pharmaceutic	adults, 16 yrs		financial	2013-	\$130 through ISPA									
		al care	and older		costs, bottom	Dec	1.82 through nurse managed									
		quality,			up	2013										
		clinical					Staff cost per item dispensed									
		outcomes					\$0.41 through ISPA									
		and provider					\$0.81 through nurse managed									
		staff costs														
		between task														
		shifting														
		pharmaceutic														
		al care														
		models														

53	Long (2016)	Compare outcomes and costs of NIMART between primary health clinics and hospital based HIV clinics	Adults >18yr	Provider	Full financial costs, bottom up	2014	Average cost for all patients: 323.74 HIV outpatient 201.63 PHC Average cost per patient alive & in care 405.15 HIV outpatient 225.29 PHC Average cost per dead/LTFU 115.49 HIV outpatient 94.66 PHC	All patients (95%) 308.60-338.89 193.11-210.15 Alive & in care 399.47-427.87 220.56-230.97 Dead/LTFU 100.34-129.69	X	x	x	X	x	х	X		
			<u> </u>					82.36-106.97			<u> </u>		Ш	\perp	\perp	\perp	
	4. SMS not													 			
33	De Tolly (2012)	Investigate effectiveness of SMS to encourage HCT	General population	Provider	Full financial costs, bottom up	N/S (?2011)	\$0.02 per sms \$1.76 per additional tester	N/S									Cost per sms
	5. Adheren	ce clubs				<u> </u>			<u> </u>								

34	Bango (2016)	Assess cost effectiveness of lay health worker led group adherence clubs and describe and evaluate the associated patient costs	Adult, stable patients	Provider and patient costs	Full financial costs, top down	2011	Total cost per visit: \$12.97 adherence club \$14.16 standard of care Patient transport costs \$0.71 adherence club \$1.15 standard of care Total cost per patient yr \$235.45 adherence club \$293.53 standard of care	N/S	x		x	x	x	x	х	x	Patient opportunity costs
36	Basset (2007)	Evaluate the yield of routine VCT vs provider referred VCT	General population	Provider	Full financial costs, top down	Jan – Mar 2005	Cost per test \$9 referral \$8.56 routine VCT Cost per HIV positive person identified \$13.48 referral \$25.81 routine VCT	N/S				x	x	x			
1	Hausler (2006)	Cost and effectiveness of a package of TB and HIV interventions	General population in Cape Town; CHC, PHC and STI clinic	Provider	Full economic cost, ingredients approach	2001 - 2002	Cost per VCT completed \$14.10 at community care center \$17.24 at primary health clinic \$10.97 at STI clinic Cost per HIV infection averted \$145.74 at community health center \$175.51 at primary health clinic \$104.99 at STI clinic	N/S		x		x	x	x	x		

37	McConnel (2005)	Determine the cost of a client completing VCT through rapid test technology	General population	Provider	Full economic and financial costs, top down	June 2002 – May 2003	Cost per counselling and test \$116.45 economic cost \$68.85 financial cost Cost per completed VCT sequence \$121.89 economic cost \$72.07 financial cost	N/S			x x	X	x			
	7. Home H	IV counselling a	and testing													
39	Smith (2015)	Evaluate impact and cost effectiveness of a community based home HTC package	Adult population (over 18 years)	Provider	Full financial costs, bottom up and ingredients	N/S	Cost per HIV negative test \$20.52 research model \$8.67 operation model Cost per HIV positive test \$35.29 research model \$23.28 operational model Incremental cost effectiveness \$21,920 per HIV infection averted \$1,335 per DALY averted	90% of model variability \$11,300-\$75,900 \$1080-1760	x	x	x	x	x	x	x	End of life care
40	Tabana (2015)	Examine the cost effectiveness of home based testing in rural SA	General population	Provider	Full financial costs, ingredients approach	Jan – Dec 2010	\$23.08 cost per home based client \$30.24 cost per clinic client	N/S			x	х	x	х		Field materials

41	Hongoro	Establish cost	General	Provider	Full financial	2007/	Cost per home visit	N/S		Х		Х	Х	Х		х		\Box
	(2011)	and cost	population		costs, top	2008	\$77.51 not including capital costs											
	, ,	drivers of a	'		down		\$109.87 including capital costs											
		hospital																es
		palliative					Cost per home visit registered patient											arg
		outreach					\$724.00 not including capital costs										-	5
		service					\$1,026.29 including capital costs											rest
							Cost per hospital visit											INTE
							\$87.45 not including capital costs											auc
							\$119.82 including capital costs											Bank and interest charges
							Cost per hospital registered patient											מ
							\$156.88 not including capital costs											
							\$214.94 including capital cost											
	9. Point o	f care CD4 testin	g			•					•						•	
44	Larson	Estimate cost	N/A	Provider	Full financial	2010	\$19.42 cost per test	N/S				Х	х		х			٦
	(2012)	of CD4 point			costs, bottom													
		of care			up		\$20.02 cost per successfully completed											ایب
		testing					test											cos
																		Insurance cost
																		rar
																		nsu
																		=
	10. Volun	tary medical ma	le circumcision	(VMMC)					-									1

46	Tchuenche (2016a)	Derive the unit cost of delivering VMMC at the facility level and to identify the level of spending currently incurred for VMMC demand creation	Men and boys	Provider	Full financial costs, ingredients	Jan-Dec 2014	Per circumcision performed \$124.95 across all facilities \$131.11 in facilities with outreach services \$123.15 in facilities without outreach services \$110.75 urban facilities \$137.26 peri-urban facilities \$111.70 rural facilities \$145.78 in hospitals \$114.54 health care centre/clinic	\$116.24- 145.97 \$115.37- 130.94 \$136.87- 154.69 \$105.97-	X		x	x	x	x	x		
47	Tchuenche (2016b)	To provide useful information on the scope of financial barriers that VMMC clients face	Follow up VMMC clients	Patient	Full economic costs, bottom up	-	Average transport costs \$8.26 all clients \$9.43 urban clients \$7.45 peri-urban clients \$9.70 rural clients	N/S	*	(x	Opportunity costs

IQR – Interquartile range

CI – Confidence interval

ISPA – Indirectly supervised pharmacist assistant